# G. William Chapman IV

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## SUMMARY

Upcoming PhD graduate in computational neuroscience, with an additional 6 years as a software developer and scientific analyst in research-oriented settings. As a scientific analyst I have specialized in temporally-aware analysis, with a strong emphasis on interacting with subject-experts. As an independent researcher, I have focused on novel neural network architectures to support prediction of spatiotemporal data.

## EDUCATION

- **Boston University** — Boston, MA
  *Doctor of Philosophy - Computational Neuroscience* — *December 2022 (expected)*

- **University of Colorado** — Boulder, CO
  *Master of Arts - Cognitive Psychology* — *2018*

- **Boston University** — Boston, MA
  *Bachelor of Science - Biomedical Engineering* — *2012*

## SKILLS

- **Languages**: Python, MATLAB, R, Bash, SQL, LaTeX
- **Frameworks**: Scikit Learn, PyTorch, Pandas, Numpy, Slurm, SGE, Git
- **General**: Machine Learning, Time Series, Project Management, Scientific & Data Communication, Advanced Statistical Analysis, Dynamical Systems, Biomedical Engineering

## EXPERIENCE

- **Boston University** — Boston, MA
  *Graduate Research Fellow* — *2018 - Present*
  - **Biological Predictive Coding**: Created a novel, biologically inspired, machine learning architecture and learning rule for predicting temporal sequences. Functions above SOTA for both short-term and long-term sequence prediction, with applications for lifelong learning, and generalization.
  - **Egocentric-Allocentric Transformations**: Created a computational model which receives self-centered sensor and motor information, fusing the information through recurrent hidden layers. Hidden layers create explicit reference-frame transformations, in addition to low-dimensional latent representations.
  - **Symbolic Predictive Learning**: Created a machine-learning model which utilizes predictive coding and dynamic routing (attention) to solve a symbolic reasoning task.

- **eCortex & University of Colorado** — Boulder, CO
  *Neural Modeler* — *2016 - 2018*
  - **Electrophysiology & Symbolic Reasoning**: Extended existing computational models of working memory to create a model capable of simple symbolic processing, utilizing attentional mechanisms. Designed and ran a corresponding EEG experiment to test model predictions. Created novel causal frequency-time analyses to determine timecourse of functional connectivity.

- **Center for Systems Neuroscience** — Boston, MA
  *Research Software Engineer* — *May 2012 - August 2016*
  - **CMBHOME**: Primary contributor for centralized MATLAB-based OOP software for standardized data storage and analysis pipelines of neural and behavioral data across multiple labs.
  - **Research**: Primary statistical analysis expert for over ten peer-reviewed publications in systems and computational neuroscience, including time-series analysis, frequentist statistics, generalized linear models, and data exploration.

- **Boston Medical Center** — Boston, MA
  *Neuroimaging Research Assistant* — *May 2009 - May 2012*
  - **Alzheimer's Disease**: Primary individual for data pipelines and novel analysis of structural MRI and behavioral data, leading to predictive models of clinical Alzheimer's Disease progression.

## Publications

1. A. S. Alexander, J. C. Tung, G. W. Chapman, A. M. Conner, L. E. Shelley, M. E. Hasselmo, and D. A. Nitz, "Adaptive integration of self-motion and goals in posterior parietal cortex," *Cell Reports*, vol. 38, p. 110504, Mar. 2022

2. L. C. Carstensen, A. S. Alexander, G. W. Chapman, A. J. Lee, and M. E. Hasselmo, "Neural responses in retrosplenial cortex associated with environmental alterations," *iScience*, vol. 24, p. 103377, Nov. 2021

3. M. E. Hasselmo, A. S. Alexander, A. Hoyland, J. C. Robinson, M. J. Bezaire, G. W. Chapman, A. Saudargiene, L. C. Carstensen, and H. Dannenberg, "The unexplored territory of neural models: Potential guides for exploring the function of metabotropic neuromodulation," *Neuroscience*, p. S0306452220302141, Apr. 2020

4. A. S. Alexander, J. C. Robinson, H. Dannenberg, N. R. Kinsky, S. J. Levy, W. Mau, G. W. Chapman, D. W. Sullivan, and M. E. Hasselmo, "Neurophysiological coding of space and time in the hippocampus, entorhinal cortex, and retrosplenial cortex," *Brain and Neuroscience Advances*, vol. 4, p. 239821282097287, Jan. 2020

5. A. S. Alexander, L. C. Carstensen, J. R. Hinman, F. Raudies, G. W. Chapman, and M. E. Hasselmo, "Egocentric boundary vector tuning of the retrosplenial cortex," *Science Advances*, July 2019

6. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Neuronal representation of environmental boundaries in egocentric coordinates," *Nature Communications*, vol. 10, p. 2772, Dec. 2019

7. C. K. Monaghan, G. W. Chapman, and M. E. Hasselmo, "Systemic administration of two different anxiolytic drugs decreases local field potential theta frequency in the medial entorhinal cortex without affecting grid cell firing fields," *Neuroscience*, vol. 364, pp. 60–70, 2017

8. J. R. Hinman, M. P. Brandon, J. R. Climer, G. W. Chapman, and M. E. Hasselmo, "Multiple Running Speed Signals in Medial Entorhinal Cortex," *Neuron*, vol. 91, no. 3, pp. 666–679, 2016

9. M. Ferrante, C. F. Shay, Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Post-Inhibitory Rebound Spikes in Rat Medial Entorhinal Layer II/III Principal Cells: In-Vivo, In-Vitro, and Computational Modeling Characterization," *Cerebral Cortex*, no. March, 2016

10. Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Rebound spiking properties of mouse medial entorhinal cortex neurons in vivo.," *The European journal of neuroscience*, vol. 42, pp. 2974–2984, Jan. 2015

11. C. F. Shay, M. Ferrante, G. W. Chapman, and M. E. Hasselmo, "Rebound spiking in layer II medial entorhinal cortex stellate cells: Possible mechanism of grid cell function," *Neurobiology of Learning and Memory*, 2015

12. F. Raudies, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Head direction is coded more strongly than movement direction in a population of entorhinal neurons," *Brain Research*, vol. 1621, pp. 355–367, Sept. 2015

13. A. L. Jefferson, K. A. Gifford, S. Damon, G. W. Chapman, D. Liu, J. Sparling, V. Dobromyslin, and D. Salat, "Gray & white matter tissue contrast differentiates Mild Cognitive Impairment converters from non-converters," *Brain Imaging and Behavior*, vol. 9, pp. 141–148, June 2015

14. K. a. Gifford, D. Liu, S. M. Damon, G. W. Chapman, R. R. Romano, L. R. Samuels, Z. Lu, and A. L. Jefferson, "Subjective Memory Complaint Only Relates to Verbal Episodic Memory Performance in Mild Cognitive Impairment," *Journal of Alzheimer's Disease*, vol. 44, pp. 309–318, Jan. 2015

## Professional Service

- **Invited reviewer**: Neural Networks (2018-present); Neural Information Processing Systems (NeurIPS) (2019-present); International Conference on Learning Representations (ICLR) (2020-present)

- **Academic Planning Committee**: Graduate Student representative on a small panel of faculty responsible for overseeing and approving changes in undergraduate and graduate degree program requirements. 2018 - 2019.

## Conference Talks and Posters

1. G. W. Chapman and M. E. Hasselmo, "Trajectory prediction in a biologically inspired network with a strong inductive bias," Oct. 2020

2. G. W. Chapman and M. E. Hasselmo, "Trajectory prediction in a biologically inspired network," Nov. 2020

3. G. W. Chapman, "A model of relational reasoning through selective attention and working memory," Mar. 2019

4. L. C. Carstensen, A. Alexander, G. W. Chapman, and M. E. Hasselmo, "Representations of landmarks in the retrosplenial cortex," Oct. 2019

5. A. Alexander, L. C. Carstensen, G. W. Chapman, F. Raudies, J. R. Hinman, and M. E. Hasselmo, "Egocentric boundary vector tuning of the retrosplenial cortex," Oct. 2019

6. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Neuronal representation of egocentric boundaries in egocentric coordinates," Oct. 2018

7. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Egocentric representation of environmental boundaries in the striatum," June 2018

8. L. C. Carstensen, A. Alexander, J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Spatial correlates of the retrosplenial cortex during free exploration," Oct. 2018

9. A. Alexander, L. C. Carstensen, F. Raudies, G. W. Chapman, J. R. Hinman, and M. E. Hasselmo, "Retrosplenial and entorhinal cortical representations during visually-based triangulation," Oct. 2018

10. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Egocentric representation of environmental boundaries in the striatum," Oct. 2017

11. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Representation of environmental boundaries within an egocentric reference frame," Oct. 2016

12. Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "In Vivo rebound spike characteristics of medial entorhinal cortex cells," Oct. 2015

13. C. K. Monaghan, G. W. Chapman, and M. E. Hasselmo, "Medial Septal infusion of a serotonin 1A agonist anxiolytic reduces theta frequency in the medial entorhinal cortex," Oct. 2015

14. J. R. Hinman, J. R. Climer, G. W. Chapman, and M. E. Hasselmo, "A novel slow oscillatory neuron in the lateral septum," Oct. 2015

15. C. F. Shay, M. Ferrante, G. W. Chapman, and M. E. Hasselmo, "Layer II Medial Entorhinal Cortex Stellate cells in rat display phase specific post inhibitory rebound spiking," Nov. 2014

16. M. Ferrante, C. F. Shay, Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Modeling Intrinsic and Extrinsic mechanisms in rat entorhinal cortex and hippocampus that may influence grid and place cells," Nov. 2014

17. J. R. Climer, R. DiTullio, J. R. Hinman, G. W. Chapman, M. P. Brandon, M. E. Hasselmo, and U. T. Eden, "Addressing Theta rhythmicity in extracellularly recorded neurons in rat and bat," Oct. 2014

18. F. Raudies, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Movement Direction is Not Coded by the Firing of Most Entorhinal Cells, but Required by Grid Cell Models," Oct. 2013

19. J. R. Hinman, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Speed Modulation of Medial Entorhinal Cortical Neurons During Medial Septal Inactivation," Oct. 2013

20. K. A. Gifford, S. Damon, R. R. Romano, G. W. Chapman, and A. L. Jefferson, "Cognitive Complaints are related to memory performance in older adults with Mild Cognitive Impairment," Feb. 2013

21. M. Ferrante, C. F. Shay, G. W. Chapman, M. Migliore, N. J. Kopell, H. Eichenbaum, and M. E. Hasselmo, "Modeling Intrinsic and Extrinsic Mechanisms in Rat Entorhinal Cortex and Hippocampus that May Influence firing of grid and place cells," Oct. 2013

22. G. W. Chapman, N. W. Schultheiss, M. P. Brandon, and M. E. Hasselmo, "Theta Cycle Skipping Relationships in the Medial Entorhinal Cortex are Robust," Oct. 2013

23. A. L. Jefferson, G. W. Chapman, J. Sparling, K. A. Gifford, B. Martin, V. Dobromyslin, and D. Salat, "Semi-automated Method for Quantifying Infarcts in Older Adults with and without Dementia," Feb. 2012

24. G. W. Chapman, A. L. Jefferson, K. A. Gifford, J. Sparling, N. Cantwell, R. R. Romano, V. Dobromyslin, and D. Salat, "Grey-White Matter Contrast Ratio Relates to Progression in Mild Cognitive Impairment.," July 2012

25. G. W. Chapman, A. Gentile, N. Cantwell, V. Williams, D. Salat, and A. L. Jefferson, "White Matter Integrity in Entorhinal Cortex & Parahippocampal Region is Associated with Memory Performances in Individuals with Mild Cognitive Impairment.," Feb. 2010

26. M. Badaracco, K. A. Gifford, A. Gentile, G. W. Chapman, Y. Tripodis, and A. L. Jefferson, "The Relation of Hypertension to Cognition in Observational Studies: A Meta-Analysis," Feb. 2010